Amendments to the Specification

Please insert the following replacement paragraph [0016] at page 4:

-- [0016] Therefore, it is another objective of the present invention to provide a nucleic acid sequence amplification method and apparatuses thereof that are simpler than the prior art so that they can be readily miniaturized and thus integrated into complex miniaturized apparatuses such as ~~Lap-on-a-chip~~ Lab-on-a-chip. –

Please insert the following replacement paragraph [0064] at pages 10-11:

-- [0064] For instance, the high temperature region 1 located at ~~the bottom~~ a lower portion of the sample may be maintained at a temperature between 90 to 94℃ at which temperature double strand DNAs can be separated into single strand DNAs. Such arrangement makes the denaturation step occur mainly in the region 1. The low temperature region 2 located at an upper portion of the sample may be maintained at the annealing temperature between 35 to 65℃ so that the DNAs denatured at the high temperature region at the ~~bottom~~ lower portion moves to the low temperature region at the upper portion by thermal convection, and therefore the single stranded DNAs can anneal with the primers that are complementary to the single stranded DNAs, forming DNA-primer complexes. In this arrangement, if *Taq* DNA polymerase, known to have its optimal activity at 72℃ and a wide temperature range of activity even to low temperature, is used for polymerization, the polymerization step, where DNA polymerase binds to the DNA-primer complex and the primer is extended, can occur in the low temperature region 2 and at the upper portion of the convection region 5. Therefore, the denaturation step occurs first in the high temperature region 1 and the denatured DNAs move to

the low temperature region 2 by thermal convection. The annealing step thus occurs in the low temperature region in the presence of the primers. The polymerization step finally occurs in the presence of DNA polymerase during the time period that the DNA-primer complexes formed in the annealing step are passing through the low temperature region 2 and the convection region 5 by thermal convection. Consequently, the denaturation, annealing, and polymerization steps can occur sequentially and repeated, thereby amplifying efficiently the target sequences of the sample DNA. --

Please insert the following replacement paragraphs [0067] and [0068] at pages 12-13:

-- [0067] Figure 3 shows a cross sectional view (Figure 3a) and a perspective view (Figure 3b) of the nucleic acid sequence amplification apparatus according to one embodiment of the present invention. The apparatus shown in Figure 3 comprises a plurality of heat sources as means for maintaining temperature, which include a heating unit; a cooling unit; or a combination of a heating unit and a cooling unit. Preferably, an insulating means may be included in between the heat sources to thermally insulate the heat sources. In this particular embodiment, the apparatus comprises first and second heat sources that are in thermal contact with specific regions of the sample. The first heat source consists of a first thermally conductive block 101 and an electric heating unit 104 that supplies heat to the first thermally conductive block. The first thermally conductive block is in thermal contact with ~~the bottom~~ a lower portion of the reaction vessel to form a high temperature region at ~~the bottom~~ a lower portion of the sample. The second heat source consists of a second thermally conductive block 102 and a circulating water bath that circulates water at certain temperature through the inside of the second thermally conductive block to maintain the temperature of the second thermally

conductive block at a suitable temperature. The second thermally conductive block 102 is in thermal contact with ~~the~~ an upper portion of the reaction vessel to form a low temperature region at ~~the~~ an upper portion of the sample. The second thermally conductive block 102 comprises an inlet 105 though which water flows in from the water bath, an outlet 106 through which the water flows out, and a fluid circulation channel for circulating the water inside the second thermally conductive block. Although the fluid circulation channel in the second thermally conductive block is not depicted in Figure 3, the person skilled in the art can understand that the fluid circulation channel is designed to transfer heat uniformly to the second thermally conductive block 102. The material of the thermally conductive blocks 101 and 102 is selected to be copper that has a high thermal conductivity, and an insulator 107 is inserted between the two blocks to prohibit direct heat transfer. The first and second thermally conductive blocks 101 and 102 have receptor openings for introduction of the reaction vessels. The receptor opening consists of an opening 111 having its one end closed in the first thermally conductive block 101, a through hole 112 in the second thermally conductive block, and another through hole 117 in the insulator.

[0068] In Example 1, 2, and 3 described later, the high temperature region at ~~the bottom~~ a lower portion of the sample is maintained at 94℃ by controlling the electric heating unit 104, and the low temperature region at ~~the~~ an upper ~~region~~ portion of the sample at 45℃ by controlling the temperature of water in the circulating water bath. --

Please insert the following replacement paragraph [0070] at page 14:

-- [0070] Firstly, the structures of the thermally conductive blocks 101 and 102 may be modified. For instance, the first thermally conductive block 101 may be contacted thermally

with ~~the bottom~~ a lower portion of the reaction vessel and the second thermally conductive block 102 with ~~the~~ an upper portion of the reaction vessel, while ~~the middle~~ an intermediate portion of the reaction vessel may be contacted with air or a third thermally conductive block. In addition, different from the embodiment depicted in Figure 3 in which heat is transferred from the blocks to the specific regions of the sample through the wall of the reaction vessel, the thermally conductive blocks may be contacted directly with the sample. --

Please insert the following replacement paragraph [0077] and [0078] at pages 15-16:

-- [0077] Figure 4 shows a temperature distribution measured at various heights from the bottom of the reaction vessel, demonstrating the principle of the PCR process based on the thermal convection. The thermal convection is a phenomenon by which movement of fluid is induced by a density difference generated by difference in temperature. This type of convection is referred to as a natural convection, distinguished from a forced convection where fluid is forced to move by a pump or a propeller. The term convection as used in the present invention always refers to a natural convection. For a natural convection to occur in the reaction vessel, ~~the bottom~~ a lower portion of the sample in the reaction vessel should be higher in temperature than ~~the~~ an upper portion.

[0078] As can be seen in Figure 4, when the first thermally conductive block 101 contacting with ~~the bottom~~ a lower portion of the reaction vessel is maintained at 96℃ and the second thermally conductive block 102 contacting with ~~the~~ an upper portion at 45℃, the high temperature region (the region with the temperature higher than or equal to 90℃ in Figure 4),

the low temperature region (the region with the temperature near 50℃), and the convection region (the region having a temperature gradient) are formed. The sample is subject to the denaturation step in the high temperature region. The denatured sample then moves to the low temperature region across the convection region, in which the sample is subject to the annealing step. While staying in the low temperature region and moving back through the convection region from the low temperature region, the sample is subject to the polymerization step. Thermal convection causes the sample to circulate the three regions sequentially and repeatedly, thereby leading to amplification of nucleic acid sequences by PCR. --

Please insert the following replacement paragraph [0080] at pages 16-17:

-- [0080] In the nucleic acid sequence amplification method of the thermal convection type according to the present invention, DNA polymerases that are not thermostable, such as *Klenow* fragment and T7 DNA polymerase, may be used in addition to the thermostable polymerases such as *Taq* DNA polymerase. This is due to the following fact. By the virtue of the characteristics of the present invention, the temperature of the total sample does not change from a high temperature to a low temperature or vice versa repeatedly, but the specific regions in the sample are maintained at constant temperatures. For instance, ~~the~~ an upper portion of the sample may be maintained at a low temperature, whereas ~~the bottom~~ a lower portion of the sample may be maintained at a high temperature. It is possible to use DNA polymerase that is not thermostable, by locating the immobilized DNA polymerase in the low temperature region or in the upper portion of the convection region near the low temperature region. --